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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/801,390	03/07/2001	H. Sam Bergh	2000-022	4042

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EXAMINER	
SODERQUIST, ARLEN	

ART UNIT	PAPER NUMBER
1743	

DATE MAILED: 06/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/801,390	BERGH ET AL.	
	Examiner	Art Unit	
	Arlen Soderquist	1743	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 March 2005*.

2a)☒ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-183 and 186-191* is/are pending in the application.

4a) Of the above claim(s) *191* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-183 and 186-190* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1. Newly submitted claim 191 is directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: the claim is directed to having each of the three listed variables different for each of the at least four reactors with no limitation on the type of fluid distribution system while the instantly examined claims, 177-178, each limit the type of restrictors used in the system and only require that one of the variables be varied.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claim 191 withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

2. The disclosure is objected to because of the following informalities: only the status of the parent utility application(s) needed updating (the provisional applications do not become abandoned).

Appropriate correction is required.

3. Claims 186-190 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claim 186 it is not clear if the cavities are included in the structure or if the claim is simply met by four capillaries or flow restrictors (orifices) of different size. Relative to claims 189-190, the question is if the limitations are further limiting since there is the possibility that the cavities are not positively recited structure of the flow distribution system.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. Claims 1-183 and 186-190 are rejected under 35 U.S.C. 103(a) as being unpatentable over Creer in view of Calleja, Roberts (US 3,875,499, newly cited and applied) and Southgate (US 5,863,502). In the paper Creer teaches the design and construction of a multichannel microreactor for catalyst evaluation. The system is shown in figure 2 and includes 6 reactors with inlets and outlets, a fluid distribution system including on/off valves, mass flow controllers, flow meters and pressure gauges and a gas chromatograph with flame ionization detector. Figure 3 shows an improved system using a mass selective detector (see page 93, last paragraph for this and additional improvements being worked on). Page 89, in the first full paragraph teaches that the four-way selection valves of the fluid distribution system allows for the feeding of up to four different reactants to six different catalysts. With this setup six different catalyst can be tested with the same gas or the same catalyst can be tested with up to four different feed gases, facilitating the rapid screening of catalysts or gas feeds. Page 91 discusses the programming of the catalyst screening microreactor. Page 92 under catalyst evaluation teaches that the unit can be used to screen a large number of catalysts in a relatively short time. The last two paragraphs of page 93 teach that valuable information can be obtained from the instrument and that the instrument is capable of being improved to provide better flow control and different detectors. Creer does not teach the instantly claimed variation in the capabilities of the fluid distribution system or that the system is formed in a substrate.

In the paper Calleja discloses a method for evaluating process conditions for converting syngas to hydrocarbons under the catalyst Co/HZSM-5 by conducting several experiments (tables 1 and 2; figs. 1-6; EXPERIMENTAL). The catalyst was prepared by the incipient-wetness impregnation technique from cobalt and thorium nitrate solutions using drying, calcination, and reduction conditions previously optimized (EXPERIMENTAL). The ZSM-5 zeolite was synthesized by an undisclosed procedure used in the laboratory. Since there is a concern with the reliability of the experimental data, such that a selected run is repeated three times under the same conditions with the catalyst replaced in the reactor every time, one would expect that each of the catalysts in the reactors are prepared under substantially the same conditions. The feed gases (H_2 and CO) and carrier gas (He) were fed into the reactor, and

products water and gasoline range hydrocarbon mixture were collected at the exit. The hydrocarbons of interest include those with at least six carbons (C_6+) whether they are aromatic, aliphatic, or olefinic. A factorial experimental design was used to establish the influence of process variables on syngas conversion. Suitable ranges of the variables were experimentally determined, and the ranges and values for the central point of the factorial design were deduced. Four experiments were carried out under the conditions of the central point of the design to determine the standard deviation of the experimental error for the objective function of yield and selectivity to C_6+. Considering the suitable experimental ranges in the orthogonal factorial design of experiments, sixteen experiments were carried out and the variables were defined in terms of statistical variables (table 1). The results were fitted to non-linear polynomial equations to express the yield and selectivity in terms of the first-order effects and all k-factor interactions. The curvature, which was confirmed by statistical analysis, shows that a simple two-level factorial design was inadequate to describe the dependence of the yield and selectivity on the variables. A higher-level factorial design was used to supplement the experimental design. A central composite design was selected, and a set of eight complementary experiments was carried out. From the experimental results, response surfaces or prediction equations for the yield and selectivity were obtained. Fig. 1 shows the response surface of yield with respect to temperature and pressure for fixed values of space velocity and CO/H_2 molar ratio. Each experiment involves controllably varying a set of reaction conditions, including space velocities, contact times, temperatures, pressures, and feed compositions and determining the conversion of CO and selectivity to C_6+ (abstract; tables 1 and 2; figs. 1-6; EXPERIMENTAL). The following tables illustrate the results from central-point experiments and supplementary experiments of complementary design.

Figure 2. Effect of Reaction Temperature on CO Conversion and C_6+ Selectivity

Experiment #	Temperature (°C)	Space Velocity (h^{-1})	CO/H_2 Feed Molar Ratio	Pressure (MPa)	CO Conversion (%)	C_6+ Selectivity (%)
1	240	0.9	1.2	2.1	11	38
2	280	0.9	1.2	2.1	33	30
3	320	0.9	1.2	2.1	62	8

Figure 3. Effect of Space Velocity on CO Conversion and C_6+ Selectivity

Experiment #	Space Velocity (h^{-1})	Temperature (°C)	CO/H_2 Feed Molar Ratio	Pressure (MPa)	CO Conversion (%)	C_6+ Selectivity (%)
4	0.5	280	1.2	2.1	42	26
5	0.9	280	1.2	2.1	34	30
6	1.3	280	1.2	2.1	25	24

Figure 4. Effect of CO/H_2 on CO Conversion and C_6+ Selectivity

Experiment #	CO/H_2 Feed Molar Ratio	Temperature (°C)	Space Velocity (h^{-1})	Pressure (MPa)	CO Conversion (%)	C_6+ Selectivity (%)
7	0.5	280	0.9	2.1	79	11
8	1.2	280	0.9	2.1	34	30
9	1.9	280	0.9	2.1	21	31

Figure 5. Effect of Reaction Pressure on CO Conversion and C_6+ Selectivity

Experiment #	Pressure (MPa)	Temperature (°C)	Space Velocity (h^{-1})	CO/H_2 Feed Molar Ratio	CO Conversion (%)	C_6+ Selectivity (%)
10	0.1	280	0.9	1.2	19	0
11	2.1	280	0.9	1.2	33	29
12	4.1	280	0.9	1.2	35	20

Figure 6. Effect of Contact Time on CO Conversion and C_6+ Selectivity

Experiment #	Contact Time (h)	Temperature (°C)	Space Velocity (h^{-1})	CO/H_2 Feed Molar Ratio	Pressure (MPa)	CO Conversion (%)	C_6+ Selectivity (%)
13	12	280	0.9	1.0	2.1	37	41
14	24	280	0.9	1.0	2.1	35	37
15	48	280	0.9	1.0	2.1	32	32
16	72	280	0.9	1.0	2.1	35	34
17	120	280	0.9	1.0	2.1	31	33
18	168	280	0.9	1.0	2.1	31	31
19	264	280	0.9	1.0	2.1	31	31

The CO conversion and C_6+ selectivity were determined from the graphs (figs. 2-6). As shown above, three different temperatures in experiments 1-3, three different space velocities experiments 4-6, three different CO/H_2 Feed Molar Ratios or compositions in experiments 7-9,

three different pressures in experiments 10-12, and seven different contact times in experiments 13-19 were used. When the varied set of reaction conditions comprise at least three different space velocities and at least two different temperatures as shown in experiments 1-6, the determined conversion of a conversion-limiting reactant includes a range of values from about 11% to about 62%, which is from less than about 10% to more than about 50%. The range of conversion values spans about a 51% conversion difference. When the varied set of reaction conditions comprise at least three different space velocities and at least two different pressures as shown in experiments 4-6 and 10-12, the range in conversion is about 19% to about 42%, which is less than about 20% to about more than about 40%. When the varied set of reaction conditions comprise three different temperatures, three different space velocities, and three different feed compositions as show in experiments 1-9, the range of values is about 11% to about 79%, which is from less than about 10% to more than about 70%. Note that the language "comprising" is open language, such that at least three different space velocities, contact times, or combinations thereof, and at least two different temperatures, pressures, or feed compositions affords three different temperatures, three different space velocities, and three different feed compositions. This is especially true when six or more reactors are claimed, such that there are six or more experiments. When the varied set of reaction conditions comprise at least three different space velocities and at least two different contact times as shown in experiments 4-6 and 13-19, the range in conversion is from about 25 % to about 42%, which is less than about 20% to more than about 40% or about 10% to about 50%. The range of conversion values spans a 17% difference, which may be viewed as at least about 10% or 20% conversion difference.

In the patent Roberts teaches a gas detecting system. The purpose of the invention is to expand the capability/range over which the detector is usable. Column 1, lines 44-54 teach that the flow rate can be extended by using a variable orifice to vary the proportion of the gas sample reaching the detector. This is taught as having a problem in coordinating the gas ratio adjustment with the other adjustments made leading to possible error in calibrating and using the system. Column 2, lines 9-13 and columns 3-4 teach the use of discrete steps in the adjustment of sample ratio by using fixed orifices of different sizes to control the sample ratio. Column 6, lines 27-32 teach that the manner in which this is doe simplifies the construction of the sample attenuator and still provides a large number of sensitivity positions.

In the patent Southgate teaches a parallel reaction cassette and associated devices. The parallel reaction device is for conducting reactions and comprises one or more reaction flow-ways, each such reaction flow-way having one or more chambers connected serially by fluid exchange channels, additional fluid exchange channels connecting the reaction channels in parallel, valve means for initiating and impeding the flow of fluids through the fluid exchange channels, and means for moving the flow of fluids into and out of the chambers. The reactors are used for automating the PCR reaction and overcome the four critical problems outlined in column 2. relevant to the instant claims are the third and fourth problems related to volume of materials used in the reaction and meaningful results through multiple parallel reactions for comparison purposes.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the reactor system of Creer with a fluid distribution system capable of performing the different reactions taught by Calleja because of the ability to characterize a catalyst as taught by Calleja in an efficient manner as taught by Creer. It would have been obvious to replace the conventional flow controllers of Creer with fixed flow restrictors as taught by Roberts because of the reduction in possible error with a variable restrictor and the simplification of construction as taught by Roberts. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the parallel reactor system of Creer in a format as taught by Southgate because of the size (volume) and meaningful results advantages taught by Southgate for the parallel reaction cassette of Southgate.

5. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection. The newly cited and applied Roberts reference provides motivation for using a fixed orifice in place of a variable orifice (conventional flow controller). The new clarity questions resulted from a reevaluation of those claims

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additionally cited art contains related patents and art relevant to gas feed or parallel reactor systems.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arlen Soderquist whose telephone number is (571) 272-1265. The examiner's schedule is variable between the hours of about 6:30 AM to about 5:00 PM on Monday through Thursday and alternate Fridays.

A general phone number for the organization to which this application is assigned is (571) 272-1700. The fax phone number to file official papers for this application or proceeding is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Arlen Soderquist

May 31, 2005

ARLEN SODERQUIST
PRIMARY EXAMINER